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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,278	09/26/2006	Yoshiaki Watanabe	063029	3371

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EXAMINER	
PETTITT, JOHN F	

ART UNIT	PAPER NUMBER
3744	

NOTIFICATION DATE	DELIVERY MODE
11/26/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentmail@whda.com

Office Action Summary	Application No.	Applicant(s)	
	10/594,278	WATANABE ET AL.	
	Examiner	Art Unit	
	John F. Pettitt	3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 October 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) *8-10* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7 and 11-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 October 2010 and 26 September 2009* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 1-7, 11-16 are objected to because of the following informalities: the recitation, "being extending vertically" (line 16) should read --extending vertically--. Appropriate correction is required.

Specification

The amendment to the specification dated 10/8/2010 is accepted. It does not appear to add any new matter.

Drawings

The amended drawings dated 10/8/2010 are acceptable relative to the changes made in overcoming the past objections, however, the drawings are objected to under 37 CFR 1.83(a) since the claims recite features which are not shown in the drawings. The drawings must show every feature of the invention specified in the claims. Therefore, the claimed second gas injection apparatus claimed in new claims 15 and 16 must be shown. However, it is noted that the applicant only has support for either a first gas injection means (9) shown in the figures originally filed or the described second gas injection means described in specification paragraphs 50-52. The applicant does not have support for both injection means.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure

number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 15-16 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The application does not have support for an apparatus having both a first gas injection means and a second gas injection means. Rather the applicant only has support for either a first or a second means.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-4, 6-7, 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the obvious modification of Swift (US 6032464).

In regard to claims 1 and 14-16, Swift (464) teaches a thermoacoustic apparatus (Fig. 13C) comprising: a loop tube (222, 210); a first stack (234) sandwiched between a first high-temperature-side heat exchanger (232; note that the heat exchangers are provided as examples and that operation at different temperatures is certainly possible) and a first low-temperature-side heat exchanger (236), the first stack (234) being provided in the loop tube (222, 210); and a second stack (216) sandwiched between a second high-temperature-side heat exchanger (218) and a second low-temperature-side heat exchanger (214), the second stack (216) being provided in the loop tube (222, 210), wherein a standing wave and a traveling wave are generated through self

excitation by heating the first high-temperature-side heat exchanger (232), so that the second low-temperature-side heat exchanger (214) is cooled by the standing wave and the traveling wave (depending on the use of the system; column 15, line 48), or wherein a standing wave and a traveling wave are generated through self excitation by cooling the first low- temperature-side heat exchanger (236), so that the second high-temperature-side heat exchanger (218) is heated by the standing wave and the traveling wave, wherein a support (inherent to locating the device in any location) is disposed such that the loop tube is configured to include first and second linear tube portions (222, 210), which are vertical and first and second connection tube portions (top and bottom ones) shorter than the first and second linear tube portions (222, 210), and wherein the first stack (234) is disposed in the first linear tube portion (210), wherein the second stack (216) is disposed in the second linear tube portion (left one of 222) than the first stack (234) is disposed, wherein the second stack (216) is disposed at a level higher that the first stack (234). It is noted that the working fluid is identified as argon (column 9, line 13) and also teaches helium (column 9, line 53).

Swift does not explicitly teach that the torus (Fig. 13C) has a gas injection apparatus. However, Swift does suggest providing an apparatus that injects gas (76, 40) in the other figures (Figures 3, 4, 13A, 13D; column 6, line 50) to either the top or bottom side of the device. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify Swift with the gas injection apparatus (76 or 40) at either the top or the bottom as described for the other

embodiments for the purpose of providing additional acoustical power input to the device.

In regard to claim 2, see figure 13C and the column 11, line 35; column 12, line 25.

In regard to claims 3-4, it is noted that the apparatus is fully capable of operating with cooling or heating either the first or second stacks (234, 216) as an operator desires.

In regard to claim 6, note that inherent to the creation of the high and low temperatures in the thermoacoustic cycle is that the pressure of the fluid peaks in the vicinity of first and second stacks (column 5, lines 10-15, 35-37, column 4, line 40).

In regard to claim 7, an acoustic wave generator is disposed inside (240) or outside (40) the loop (222, 210).

Claims 5-6, 11, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over the modification of Swift (US US 6032464) in view of Swift (US 6164073).

In regard to claim 5, Swift (464) does not appear to teach the location of the center of the stack (216) in relation to the ends of the vertical tube portions (222, 210), however, it is noted that the stack's location in Swift (464) appears to be located near the same location as in the applicant's figure. Further, it is seen that the locating of the stack in the loop is nearly inherent in order for the device to operate properly (column 5, lines 60-65 - shows that the length of the torous is explicitly considered). Lastly considering that the stack's location is shown in the Swift(464) it is considered a matter

of routine experimentation to determine the optimal location relative to the length of the loop. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to locate the stack at about ¼ the length of the tube portions for the purpose of providing the optimal thermoacoustic torus loop. Furthermore, the same reasoning applies to claim 6 in addition to the evidence that the pressures must peak near the stacks.

In regard to claim 11, Swift (464) teaches most of the claim limitations, but does not explicitly teach a stack structure that provides flow path lengths of individual connection channels are decreased one after another from the medial to the lateral ends of the stack. However, Swift (073) teaches that the stack (32, 34) is formed from plates (column 5, line 6) in a circular cross section tube for a thermoacoustic cooler, and therefore there is a flow length (when viewing the cross-section) that is decreased when moving from the medial to the lateral ends. Swift (073) further teaches that such stack structure was previously invented (column 5, lines 1-5). Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to employ the stack structure of Swift (073) in the cooler of Swift (464) for the purpose of improving the efficiency of the cooler and employing a stack structure that has been shown to be effective.

In regard to claim 13, Swift (464) teaches most of the claim limitations, but does not appear to teach staging the low temperature heat exchangers of at least two thermoacoustic coolers. However, Swift (073) teaches such staging is old in the art of thermoacoustic coolers (column 7, lines 50-55), additionally and/or alternatively

cascade refrigeration is a well known and old method of producing lower refrigeration temperatures. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to provide cooling from one low temperature heat exchanger to another thermoacoustic cooler for the purpose of providing cooling at lower temperatures.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over the obvious modification of Swift (464) in view of Smith (US 2003/0192324) or Belaire (US 4057962). Swift (464) as modified teaches most of the claim limitations including, that the product of the anugular frequency and temperature relaxation time is in the range of 0.2 to 20 (since omega*tau = (2*PI*frequency)*(r^2 / 2*alpha and Swift (464) shows that the flow path radius is about 12 micrometers - column 9, line 35, and 42 micrometers - column 11, line 39 and the fluid is argon defining the diffusion coefficient, therefore the value is a function only of frequency which is user set and therefore the device of Swift is fully capable of such range), but does not appear to teach sintered metal for the regenerator, however, Smith (parag. 99) or Belaire (columne 3, lines 54-61) each teach that regenerators are known to be sintered. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to sinter the screens of Swift (464) for the purpose making the installation of the regenerator easier.

Claims 1-4, 6-7, 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swift (US 6032464) and any one of Wighard (US 5813234), Garrett (US 5953921), Garrett (US 5647216).

In regard to claims 1 and 14-16, Swift (464) teaches a thermoacoustic apparatus (Fig. 13C) comprising: a loop tube (222, 210); a first stack (234) sandwiched between a first high-temperature-side heat exchanger (232; note that the heat exchangers are provided as examples and that operation at different temperatures is certainly possible) and a first low-temperature-side heat exchanger (236), the first stack (234) being provided in the loop tube (222, 210); and a second stack (216) sandwiched between a second high-temperature-side heat exchanger (218) and a second low-temperature-side heat exchanger (214), the second stack (216) being provided in the loop tube (222, 210), wherein a standing wave and a traveling wave are generated through self excitation by heating the first high-temperature-side heat exchanger (232), so that the second low-temperature-side heat exchanger (214) is cooled by the standing wave and the traveling wave (depending on the use of the system; column 15, line 48), or wherein a standing wave and a traveling wave are generated through self excitation by cooling the first low- temperature-side heat exchanger (236), so that the second high-temperature-side heat exchanger (218) is heated by the standing wave and the traveling wave, wherein a support (inherent to locating the device in any location) is disposed such that the loop tube is configured to include first and second linear tube portions (222, 210), which are vertical and first and second connection tube portions (top and bottom ones) shorter than the first and second linear tube portions (222, 210),

and wherein the first stack (234) is disposed in the first linear tube portion (210), wherein the second stack (216) is disposed in the second linear tube portion (left one of 222) than the first stack (234) is disposed, wherein the second stack (216) is disposed at a level higher that the first stack (234). It is noted that the working fluid is identified as argon (column 9, line 13) and also teaches helium (column 9, line 53).

Swift does not explicitly teach that the torus (Fig. 13C) has a gas injection apparatus. However, the following references teach that it is well known to fill thermoacoustic devices with a working fluid: Wighard (US 5813234) column 1, line 37, column 8, line 3, 10-11; Garrett (US 5953921) column 4, lines 20-25; Garrett (US 5647216) column 8, line 1 and for the working fluid to be mixtures of helium and Argon. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify Swift with a gas injection apparatus at either the top or the bottom for the purpose of installing the working fluid and for the purpose of doing so while allowing the sides to remain available and free for heat transfer and for the purpose of conveniently permitting the injection of the working fluid.

In regard to claim 2, see figure 13C and the column 11, line 35; column 12, line 25.

In regard to claims 3-4, it is noted that the apparatus is fully capable of operating with cooling or heating either the first or second stacks (234, 216) as an operator desires.

In regard to claim 6, note that inherent to the creation of the high and low temperatures in the thermoacoustic cycle is that the pressure of the fluid peaks in the vicinity of first and second stacks (column 5, lines 10-15, 35-37, column 4, line 40).

In regard to claim 7, an acoustic wave generator is disposed inside (240) or outside (40) the loop (222, 210).

Claims 5-6, 11, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swift (US US 6032464) and any one of Wighard (US 5813234), Garrett (US 5953921), Garrett (US 5647216) and further in view of Swift (US 6164073).

In regard to claim 5, Swift (464) as modified does not appear to teach the location of the center of the stack (216) in relation to the ends of the vertical tube portions (222, 210), however, it is noted that the stack's location in Swift (464) appears to be located near the same location as in the applicant's figure. Further, it is seen that the locating of the stack in the loop is nearly inherent in order for the device to operate properly (column 5, lines 60-65 - shows that the length of the torous is explicitly considered). Lastly considering that the stack's location is shown in the Swift(464) it is considered a matter of routine experimentation to determine the optimal location relative to the length of the loop. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to locate the stack at about ¼ the length of the tube portions for the purpose of providing the optimal thermoacoustic torus loop. Furthermore, the same reasoning applies to claim 6 in addition to the evidence that the pressures must peak near the stacks.

In regard to claim 11, Swift (464) as modified teaches most of the claim limitations, but does not explicitly teach a stack structure that provides flow path lengths of individual connection channels are decreased one after another from the medial to the lateral ends of the stack. However, Swift (073) teaches that the stack (32, 34) is formed from plates (column 5, line 6) in a circular cross section tube for a thermoacoustic cooler, and therefore there is a flow length (when viewing the cross-section) that is decreased when moving from the medial to the lateral ends. Swift (073) further teaches that such stack structure was previously invented (column 5, lines 1-5). Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to employ the stack structure of Swift (073) in the cooler of Swift (464) for the purpose of improving the efficiency of the cooler and employing a stack structure that has been shown to be effective.

In regard to claim 13, Swift (464) as modified teaches most of the claim limitations, but does not appear to teach staging the low temperature heat exchangers of at least two thermoacoustic coolers. However, Swift (073) teaches such staging is old in the art of thermoacoustic coolers (column 7, lines 50-55), additionally and/or alternatively cascade refrigeration is a well known and old method of producing lower refrigeration temperatures. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to provide cooling from one low temperature heat exchanger to another thermoacoustic cooler for the purpose of providing cooling at lower temperatures.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over the obvious modification of Swift (464) and any one of Wighard (US 5813234), Garrett (US 5953921), and Garrett (US 5647216) and further in view of Smith (US 2003/0192324) or Belaire (US 4057962). Swift (464) as modified teaches most of the claim limitations including, that the product of the anugular frequency and temperature relaxation time is in the range of 0.2 to 20 (since omega*tau = (2*PI*frequency)*(r^2 / 2*alpha and Swift (464) shows that the flow path radius is about 12 micrometers - column 9, line 35, and 42 micrometers - column 11, line 39 and the fluid is argon defining the diffusion coefficient, therefore the value is a function only of frequency which is user set and therefore the device of Swift is fully capable of such range), but does not appear to teach sintered metal for the regenerator, however, Smith (parag. 99) or Belaire (columne 3, lines 54-61) each teach that regenerators are known to be sintered. Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to sinter the screens of Swift (464) for the purpose making the installation of the regenerator easier.

Response to Arguments

Applicant's arguments filed 10/8/2010 have been fully considered but they are not persuasive.

1. Applicant's arguments (page 9, ¶ 2) are that the claim objection has been obviated. In response, it is agreed and the objection is withdrawn.

2. Applicant's arguments (page 9, ¶ 3) are that amendment to the drawings has obviated the objection. In response, it is agreed and the objection over previous

grounds is withdrawn. However, with the admission of new claimed subject matter, a further objection has been made above.

3. Applicant's arguments (page 9, ¶ 5 - page 10, ¶ 1) are that amendment to the claims has obviated the 112 2nd rejection. In response, it is agreed and the rejection is withdrawn.

4. Applicant's arguments (page 10-11) are that the amendment has overcome the prior art. In response, the examiner disagrees and directs the applicant to the rejection above detailing how the prior art meets the claim limitations and the evidence provided by Swift (464) as well as the evidence provided by Wighard and Garrett that show that mixtures of helium and argon are known in the art for their balanced thermophysical and physical properties.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John F. Pettitt whose telephone number is 571-272-0771. The examiner can normally be reached on M-F 8a-4p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler or Frantz Jules can be reached on 571-272-4834 or 571-272-6681. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John F Pettitt /
Examiner, Art Unit 3744

/Cheryl J. Tyler/
Supervisory Patent Examiner, Art Unit 3744

JFP III
November 17, 2010